Authority NND 735022

CONFIDENTIAL

REPORT

of

THE INFANTRY BOARD

No. 1826

PARTIAL REPORT ON LAUNCHER, ROCKET, 3.5", T74
AND ROCKET, 3.5", T80

FORT BENNING, GEORGIA

16 July 1945

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6th Ind.

HEADQUARTERS ARMY GROUND FORCES, Washington 25, D. C., 26 Oct 1945

TO: Commanding General, Army Service Forces. ATTENTION: Research and Development Division, Room 4E 633, The Pentagon.

1. Herewith report of test of Rocket, 3.5", T80, conducted by Army Ground Forces Board #3.

2. It will be noted from the report that the service performance of the rocket is satisfactory, except for inadequate waterproofing of the propellant chamber. In view of that deficiency, recommendation for the standardization of the rocket is withheld for the present.

3. It is requested in lieu thereof, that development be expedited to improve the waterproofing characteristics of the propellant chamber, as cited in paragraphs 5b and 7a of the subject report, and twenty-five rounds of the modified rockets be furnished Army Ground Forces Board No. 3 for further test.

4. For your information, a review of the requirements for the Launcher, Rocket, 3.5", M-20, is now under study and a complete and revised basis of issue will be furnished your headquarters in the near future.

FOR THE COMMANDING GENERAL:

st/ W. A. TRACY
Capt., A. G. D.
Asst. Ground Adj. Gen.

1 Incl
Orig, dup, trip & quad w/d

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IB-471.6

16 JUL 1945

SUBJECT: Partial Report on Launcher, Rocket, 3.5", T74
and Rocket, 3.5", T80.

THROUGH: The Commandant, The Infantry School.

TO: The Commanding General, Army Ground Forces,
Army War College, Washington 25, D. C.

1. This is a partial report in so far as the Rocket, T-80, is concerned, owing to information that the rockets furnished for test are not of the final model. It is complete and final as to the Launcher, Rocket, 3.5", T-74.

2. Authority for test of subject material was given in 2nd Ind., Headquarters Army Ground Forces, 25 April 1945, 471.94 (C) (11 Apr 45) GNRQT-11/23297, on letter, Office of Chief of Ordnance to Commanding General, Army Service Forces, dated 11 April 1945, O.O. No. 471.94/5149 (C) SPOTU, Subject: Request for Test of 3.5" Rocket, T80 and Launcher, T74. (Appendix B)

3. Description of Material:

a. The Rocket, 3.5", T74, is to all intents and purposes an enlarged and improved version of the now familiar Rocket, 2.36", M6A1. It consists of an armor piercing, shaped charge of high explosive in a metal head furnished with a blunt-pointed hollow nose designed to give the proper stand-off for the shaped charge, attached to cylindrical tail which combines a fuze, a rocket motor of the usual type with a stabilizer assembly. A spring-loaded plunger or "bore rider" projecting from the side of the fuze provides bore safety by preventing final arming of the fuze until the plunger clears the muzzle of the launcher. Initial arming is by set-back. A feature of the fuze body is that it consists of two telescoping sections which are held in the extended position by the bore-rider plunger until the rocket is launched, but are free to telescope upon each other after the ejection of the bore rider except for the slight resistance of a creep spring. The primer and striker are located centrally in the forward section in such positions that, after launching and arming, if the rocket meets with sudden resistance the two telescoping sections collapse upon each other and force the firing-pin against the primer, detonating it. The stabilizer assembly consists of a funnel-shaped extension of the motor, to which are affixed, on its exterior surface, four small, longitudinal fins. The propellant consists of twelve sticks of BBP, with an electric squib

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igniter. The rocket is 24" long, and weighs 8.68 lbs, is approximately 3.5" in diameter at the head and tail. The explosive charge is cyclonite. (Figures 1, 3, 4, 5, 6, 7 and 8)

b. The Launcher, Rocket, 3.5", T74, is an almost exact replica of the 2.36" Rocket Launcher M9E2, and differs from it only in that it is of larger bore (3.5"), has short bell-shaped extensions at the muzzle and breech, and carries a folding type of bipod on the muzzle section of the two-piece barrel, with an adjustable third leg just in front of the shoulder stock. It is 60.5" in length, assembled, and weighs 14.88 lbs. complete. (Figures 2, 9, 10, 40, 41 and 42)

4. Purpose of the tests was to determine:

a. Ballistic and functional data, such as range, accuracy, stability in flight and operation of the weapon and ammunition.

b. The effectiveness of the weapon and ammunition against armor, pill-boxes, bunkers, masonry and cave-like emplacements.

c. What modifications, if any, are desirable to improve the capabilities of the weapon and ammunition.

d. Comparison with the 2.36" Rocket, Rifle grenade and Recoilless Weapons.

e. Methods of employment.

f. Basis of issue.

g. Adequacy of coupling of the two launcher sections.

h. Desirability of the bipod on the launcher.

i. Functioning of the rocket fuse on grazing and plate impact. (Appendix "B")

5. Factual Background. a. At the time of the adoption of the present antitank Rifle Grenade M9A1 and the Rocket, 2.36", it seemed that their power was adequate to account for armored vehicles then in use. Since then, however, enemy armies (especially the Germans) have greatly increased the weight of armor carried, and it was found that these projectiles were not in all cases adequate to deal with hostile tanks. The use of these weapons against ground emplacements, requiring maximum power in the projectile, has also become of increased importance. The 2.36" rocket and the rifle grenade

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were, moreover, somewhat unstable and inaccurate in flight and left much to be desired in hitting-ability. While improvements in power and performance of the 2.36" rocket have been made there is still room for improvement in accuracy, range and power. An obvious way to improve power in such a weapon is to increase the weight and diameter of the projectile. A serious functional defect of the standard 2.36" rocket is the insensitivity of the impact fuze which produced a large percentage of duds, and practically precluded effective use for grazing impact or for impact on soft surfaces. The subject rocket and launcher represent an attempt to obtain greater power, accuracy, range and reliability without increasing the weapon and ammunition beyond the point of usefulness for Infantry troops.

b. The present Launcher, Rocket, 2.36", known as the "Bazooka" is widely distributed throughout the Infantry regiment, but has been regarded as an occasional and additional weapon for which no special personnel were provided. It has proven highly effective in certain types of fighting, and the provision of special teams for their exclusive operation is under consideration.

c. Recent, related developments affecting the desirability of the subject weapon are:

(1) Recoilless 57mm Rifle.

(2) Recoilless 75mm Rifle.

(3) Recoilless 4.2" Howitzer (Mortar).

(4) Recoilless 105mm Rifle.

(5) High velocity 2.36" Rocket, with greatly improved accuracy, power and range (1500 - 1600 yds.) over the standard 2.36" Rocket M6A3.

d. The latest proposed (not yet approved) distribution of the 2.36" Rocket Launcher within the Infantry Regiment is as follows:

Regtl Hq Co. (T/O & E 7-12)		
Co. Hq.		4
Service Co. (T/O & E 7-13)		
Co. Hq.	8	
Tank Maint. Sec.	2	10
Cannon Co. (Heavy Tank, 105mm How)		
Co. Hq.	1	
3 Platoons (1 ea)	3	4

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Antitank Co. (Heavy Tank, 90mm gun)		
Co. Hq.	1	
3 Platoons (1 ea)	3	4
Bn Hq. Co. (T/O & E 7-16)		
Co. Hq.	2	
Comm. Plat.	1	
Amm. & Pioneer Plat.	2	5
Heavy Weapons Co. (T/O & E 7-18)		
2 Cal. .30 MG Platoons (2 ea)	4	
1 Gun Platoon	3	
1 Mortar Platoon	2	9
Rifle Company (T/O & E 7-17)		
3 Rifle Platoons (2 ea)	6	6
Total, Infantry Regiment		118

e. In the above distribution, special personnel for operation of the rocket launcher is not provided except in the Rifle Company. In the latter, one Rocket Squad, of 7 men each and 2 launchers each, is added to each rifle platoon.

6. Facts Found by The Infantry Board as a result of present tests (described in detail in the appended Record of Test) are as follows:

a. The physical dimensions and weight of the subject Launcher, Rocket, 3.5", T74 are not sufficiently in excess of the present standard Launcher, Rocket, 2.36", M9E1 to affect, unduly, its portability and usability in the field in comparison with the latter. In comparison with the latest model (M9E2) of the 2.36" Rocket Launcher (aluminum) the subject launcher is approximately 4-1/2 lbs. heavier. (Test 1)

b. The subject Rocket, 3.5", T80 is approximately 4-1/2 inches longer (24") weighs approximately 5-1/4 lbs. more (8.68 lbs.) than the present standard Rocket, 2.36", M6A3. The weight ratio is approximately 2-1/2 to 1. (Test 1)

c. The range of the subject Rocket, 3.5", T80, when launched from the subject launcher, is approximately fifty per cent (50%) greater than that of the standard 2.36" Rocket M6A3, at corresponding elevations, with a maximum range of approximately 900 yards. (Test 2)

d. The average accuracy of the subject Rocket, 3.5", T80, fired from the subject Launcher, T74, as represented by the area of the impact pattern is approximately from five to six times as great as that of the Standard Rocket, 2.36", M6A3 fired from the Standard Launcher, Rocket, 2.36",

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M9E2, at corresponding ranges (excluding personal errors). (Test 2)

e, The subject Launcher, Rocket, 3.5", T74 is readily portable on the person by an individual soldier under field conditions. (Test 3)

f. The subject Rocket, 3.5", T80, when not in a container, occupies approximately the same space in transportation as the standard 2.36" Rocket in its carton container, and can be so carried in the standard carrying-bag for the latter on the basis of three (3) rockets per bag, but with an increase of approximately two to one in the weight of the filled bag. (Test 3)

g. The subject rocket and launcher are suitable for carrying by airborne troops of all classes. (Test 4)

h. The recoil of the subject launcher firing the subject rocket is less than half that of the standard 2.36" Launcher, M9E2 firing the standard 2.36" Rocket M6A3. (Test 5)

i. The subject Rocket, 3.5", T80, functions satisfactorily and without undue back-blast or recoil, through temperature ranges usually encountered (minus 8°F. to plus 120°F.). (Test 6)

j. The subject Rocket, 3.5", T80, as received for test, is at least equal in armor-penetrating power to the standard Rocket, 2.36", M6A3, at various angles of incidence. (Note: Test not conclusive, due to lack of suitable armor-plate.) (Test 7)

k. The individual destructive effect of the subject Rocket, 3.5", on earth-covered Japanese-type bunkers is greater than that of the 2.36" Rocket M6A3, probably less than that of the 75mm Recoilless Rifle, and much less than that of the 4.2" Recoilless Howitzer (Mortar). It is effective to a limited extent in damaging and obstructing embrasures of such structures. (Test 8)

l. The subject rocket is moderately effective against sandbag emplacements, but probably less so than the 75mm Recoilless Rifle shell. It is much less effective for such use than the 4.2" Recoilless Howitzer (Mortar) Shell. (Test 9)

m. The subject rocket and launcher are more suitable for use against moving targets than the standard 2.36" Rocket and Launcher, and require a mean lateral lead on such targets at a mean range of 200 yards, of approximately 4.5 mils per mile per hour in the lateral speed of the target. (Test 10)

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n. The fuze of the subject Rocket, 3.5", T80, as received for test, functions reliably on impact either on hard or soft ground, except on grazing impact at low angles of incidence. (Test 11)

o. The fuze of the subject 3.5" Rocket does not function reliably on grazing impact at low angles (elevations for 200 and 300 yards). (Test 11)

p. When the subject Rocket, 3.5", T80, is modified by changing the contour of the ogive from pointed to cylindrical with a blunt nose, to reduce the tendency to ricochet, fuze malfunctions on grazing impact are practically eliminated, but ballistic stability and range are slightly affected (probably due in part to the crudely made nature of the improvised blunt nose). (Test 12)

q. The propellant charge of the subject Rocket, 3.5", T-80, is completely consumed within the tube of the subject T-74 Launcher. (Test 13)

r. The bipod and monopod support of the subject Rocket Launcher, 3.5", T-74, does not permit sufficient adjustment in height for use on uneven ground, and is unnecessary and very limited value in the field use of the launcher. (Test 14)

s. The observable defects of the subject Rocket and Launcher, 3.5", are as follows:

Launcher, Rocket, 3.5", T-74, None.

Rocket, 3.5", T-80:
(1) Ignition wires too short.
(2) Ogive (nose) of unsuitable shape for functioning of fuse on grazing impact.
(3) Armor penetration not up to expectation. (Test 15)

7. <u>Discussion</u>.

a. As indicated above, this report is final only on the Launcher, Rocket, 3.5", T-74, and not on the Rocket, 3.5", T-80, because informal notification was received before the commencement of the tests that the rockets as shipped to The Infantry Board were not in the final form, and further shipment of an improved model was contemplated.

b. The Launcher, T-74, appears to be completely satisfactory in all respects, as might be expected from the fact that it incorporates all the lessons of design and operation learned from several years' experience with its smaller prototype, the 2.36" Rocket Launcher in its various stages

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of development. The only question concerning the subject launcher upon which there appears to be any doubt is that of the necessity or utility of the bipod and monopod combination support. It is difficult to visualize the need for these supports, in view of the fact that the launcher, itself, is no heavier or more difficult to hold in firing than the 2.36" launchers (M9A1) now in the hands of troops in large numbers. The supports have no application except to the prone position, and then only on level, even ground. The one thing they might be useful for is for fixed fire by remote control after pre-aiming on a fixed target. Their presence does add, perhaps unnecessarily, to the load to be carried. Aside from this added weight they probably do no harm, and it is possible that further experience may indicate them as desirable. With or without these supports, the launcher appears eminently satisfactory.

A

c. The Rocket, T-80, does not fare quite so well on test, largely because in the pointed shape of the ogive or nose the designers have repeated the mistakes made, and since corrected, in the design of the original Rifle Grenade M9 and the 2.36" Rocket M6. That shape practically precludes the deceleration on grazing impact required to function the fuse. The tests show a disappointing percentage of duds on grazing ground impact at ranges up to 250 or 300 yards. To check the correctness of the impression that this was due to the shape of the nose, The Infantry Board modified a small number of these rockets by placing a false, cylindrical cup with a rounded bottom over the normal ogive, and fired the rockets so modified under the same conditions which had produced a very large percentage of malfunctions on grazing impact. The modified rocket had no malfunctions. The improvised nature of the modification, however, which added considerable weight and bulk, appeared to have a slightly adverse effect on range and stability at maximum elevation, most of which would probably not be present if the modifications were applied in a more finished form. The trouble is evidently not in the fuse, itself, since it functions extremely well under all other conditions than grazing impact. This unreliable functioning on grazing impact is believed to be a serious defect which must be remedied before the rocket can be considered satisfactory. The only other positive defect is the shortness of the ignition wire, which often caused trouble in loading. It is understood that the armor penetration is being improved and will be present in the final model.

d. Assuming that the above-mentioned defects in the subject rocket will be corrected in production there appears to be no reason to doubt its usefulness, since it appears to be a more powerful brother of the famous "Bazooka". Whether a need for this greater power will be required in future operations, now that German armor is no longer a factor, cannot be foretold, and may not be known until the nature and extent of Japanese defenses are fully known. It is believed essential to be prepared for the worst, and,

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in view of the lightense and handiness of the subject material, it would probably be a mistake to reject it or delay action on it.

e. (1) The directive requires the recommendation of a basis for distribution of the subject weapon, if adopted. This requires consideration of its characteristics in comparison with those of other weapons now available, or which will probably be available, in the same field, to determine whether it could and should displace or supplement them.

(2) The various recoilless weapons mentioned herein cannot be considered in the same general class, by reason of their relatively great weight and range. It does not seem the subject rocket and launcher could displace any of these.

(3) When the present 2.36" rocket and launcher is considered, however, a much closer relationship with the subject weapon is found, and this is especially true when we consider, as we must, the improved, or so-called high-velocity 2.36" rocket as the projectile which will be used in the 2.36" launcher, and which is substantially in the same state of development as the subject 3.5" rocket. The long range and flat trajectory of that rocket appears to make it a natural combat supplement of the shorter-range but more powerful 3.5" rocket, as the howitzer is a supplement of the gun. If this is true, then the weapons of the rocket squad of the rifle platoon should be:

1 Launcher for the high velocity, 2.36" Rocket,
1 Launcher for the (subject) 3.5" Rocket.

The above applies, wholly, however, only to front line use, that is, to use in the rifle companies. For uses farther to the rear, as for the protection of heavy weapons positions and other rearward installations, the high-velocity, long-range 2.36" rocket is not so well suited, because its long range there makes it a menace to other friendly troops. There, the shorter range of the 3.5" rocket is adequate, and its increased power will be welcome. With the above in view, the general conclusion seems justified that the subject 3.5" rocket and launcher should replace the 2.36" rocket and launcher for all behind-the-line uses, and should supplement it in the front line of the rifle companies.

8. Conclusions. The Infantry Board concludes:

a. That there is a military requirement in the Infantry for a rocket and launcher of greater destructive effect against armor and emplacements than the 2.36" rocket, but of substantially equal portability.

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b. That the subject Rocket, 3.5", T-80, after minor modifications mentioned below, and the Launcher, Rocket, 3.5", T-74, in its present form, satisfactorily fulfill such requirement, and their adoption would substantially add to the combat effectiveness of Infantry.

c. That subject Rocket, 3.5", T-80, requires the following modifications to give it maximum effectiveness:

(1) Substitute a blunt ogive for the present pointed ogive, to improve fuze functioning on grazing impact.

(2) Lengthen ignition wire and strengthen its insulation.

(3) Improve armor-piercing characteristics.

d. That additional ammunition types should be developed for the subject weapon as follows:

(1) Plasticized White Phosphorus, with impact fuze.

(2) Demolition rocket, with very short delay fuze for use against earth-covered structures, etc.

e. That the subject Launcher, Rocket, 3.5" should partly replace and partly supplement the present standard Launcher, Rocket, 2.36", in the Infantry regiment in accordance with the following schedule:

Regimental Hq & Hq Co. (T/O & E 7-12)	
Total replacement	4.
Service Co. (T/O & E 7-13)	
Total replacement	8.
Cannon Co. (Heavy Tank, How.)	
Total replacement	4.
Antitank Co. (Heavy Tank, 90mm gun)	
Total replacement	4.
Bn. Hq & Hq Co. (T/O & E 7-16)	
Total replacement	5.
Heavy Weapons Co. (T/O & E 7-18)	
Total replacement	9.
Rifle Co. (T/O & E 7-17)	
Replace half	3.

(Note: Above distribution is based on Tables of Organization recently recommended but not yet officially approved.)

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9. Recommendations. The Infantry Board recommends:

a. That the subject Rocket, 3.5", T-80, be modified in accordance with par. 8c, above, and that, when so modified, it be adopted as standard and issued to Infantry units in accordance with present schedules for the 2.36" Rocket.

b. That the subject Launcher, Rocket, 3.5", T-74, be adopted as standard for issue to Infantry, partly in replacement of and partly to supplement the present standard Launcher, Rocket, 2.36", in substantial accordance with the schedule indicated in par. 8e, above.

c. That production and issue be expedited.

d. ~~That~~ Additional ammunition for use with the subject Launcher, Rocket, 3.5", T-74, with substantially the same ballistics as the subject Rocket, 3.5", T-80, as follows:

(1) Smoke, P.W.P.

(2) Demolition, with short delay fuze for use against earth-covered emplacements.

INGOMAR M. OSETH,
Colonel, Infantry,
President.

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RECORD of TEST

ON

LAUNCHER, ROCKET, 3.5", T74, AND ROCKET, 3.5", T80

TEST SECTION
THE INFANTRY BOARD

FORT BENNING, GEORGIA

TO: THE DIRECTOR, THE INFANTRY BOARD. HEREWITH DETAILED RECORD OF TESTS RELATING TO THE ABOVE PROJECT.

EDWARD B. CROSSMAN,
Major, Infantry,
Acting CHIEF, TEST SECTION

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8 Copies.

Copy No. 6

Date 28 JUN 1945

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APPENDIX

"A"	Memorandum, The Infantry Board, IB-471.6, 2 May 1945	76
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1. Authority and References.

a. Authority

(1) Memorandum The Infantry Board, IB-471.6, 2 May 1945. (Appendix "A")

(2) Letter, Office of the Chief of Ordnance, O.O. No. 471.94/5149 (C), 13 April 1945, with three indorsements. (Appendix "B")

b. References

(1) Report of The Infantry Board, No. 1802

(2) FM 23-30

2. Introductory Information

a. The subject launcher T74 and rocket T80 are developed to provide greater armor piercing and destructive qualities than that found in the standard 2.36" rocket and launcher. (Figures 1 and 2)

b. The 3.5" Launcher, Rocket, T74, is constructed of two sections of 3.5" metal tubing that appears to be aluminum or an aluminum alloy. The sight and ignition system are the same as used on 2.36" launcher, M9A2. The tube coupling on the 3.5" launcher is similar to that on the 2.36" launcher. The subject launcher differs from the 2.36" launcher in having comparatively large bell shaped blast deflectors on the front and rear, a narrow rocket latch and a bipod on the muzzle section of the tube with an adjustable third leg in front of the shoulder stock. The method of latching the two tube sections together for carrying the launcher slung is similar on both the 3.5" and 2.36" launchers. (Figures 2, 5 and 6)

The 3.5" rocket, T80, is a projectile similar in construction to the 2.36" rocket, M6A1, in that it has a long pointed ogive on the explosive head. (Figure 1)

The fuze of the T80 rocket departs from general rocket fuzes in having a bore rider and set-back arming device built into the inertia firing mechanism. (Figures 3, 7 and 8) There is no bore safety in the M6A3 rocket 2.36". Once the T80 rocket clears the tube, any sudden retarding of the head of the projectile will cause the rear section of the rocket to slide

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the two fuze sections together, compress the creep spring and fire the primer. (Figures 3 and 4) The propellant for the T80 rocket consists of 12 sticks of BBP powder. The stabilizer fins are constructed to develop a vacuum at the rear of the rocket for stability rather than operate on the wind tunnel principle as does the M6A3 rocket.

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a b c

Comparison of 3.5" and 2.36" Rockets.

a - T80 Rocket, 3.5" Practice.
b - T80 Rocket, 3.5" H.E.
c - M6A3 Rocket, 2.36" H.E.

Figure 1

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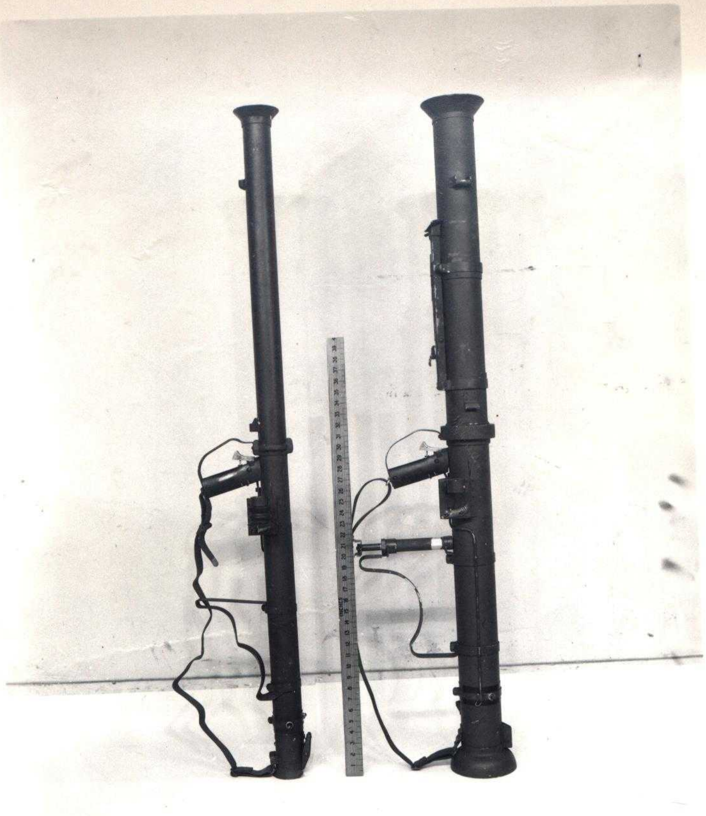

a b

Comparison of Launchers.

a - 2.36" Launcher M9E2 - length 60.75".

b - 3.5" Launcher T74 - length 60.5".

Figure 2

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a b

Firing Operation of T80 Rocket, 3.5".

a - Before impact - opening in firing mechanism indicated.

b - After impact - rocket has shortened due to impact and drives firing pin into primer.

Figure 4

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a b

Comparison of Launchers.

a - 3.5" Launcher T74 - length folded, 33".

b - 2.36" Launcher M9E2 - length folded, 31.5".

Figure 5

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3.5" Launcher T74 bipod in firing position
and support at maximum length.

Figure 6

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Components of T80 Rocket, 3.5".

a - Propellent chamber and stabilizer assembly.
b - Rocket head.
c - Fuze body - outer.
d - Fuze body - inner.
e - Primer - detonator carrier.
f - Primer - detonator.
g - Booster cup.
h - Tetryl booster.
i - Bore rider and spring.
j - Firing pin and set back arming assembly.
k - Creep spring.
l - Safety pin.

Figure 7

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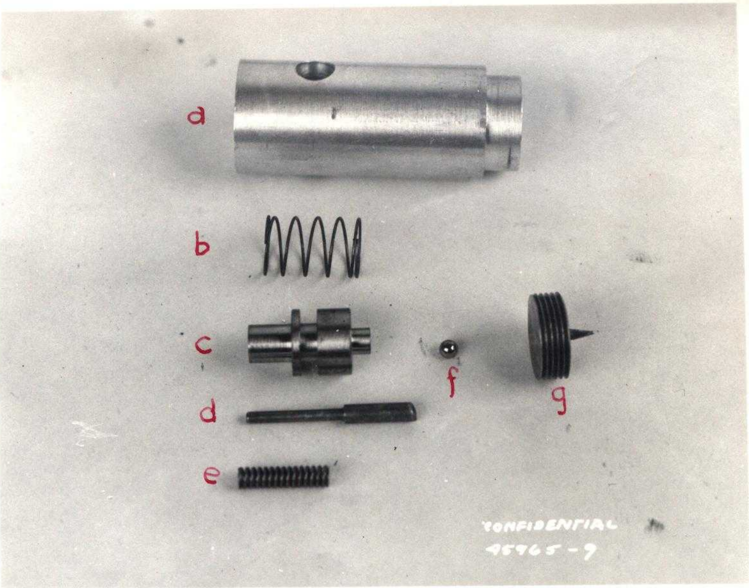

Components of firing pin and set back arming assembly.

a - Body.
b - Set back spring.
c - Set back weight.
d - Bore rider retaining pin.
e - Bore rider retaining pin retracting spring.
f - Set back release ball.
g - Firing pin body.

Figure 8

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3. Purpose of Test.

a. To determine the following for the 3.5" launcher, T74, and rocket, T80:

(1) Physical characteristics

(2) Range accuracy and stability of rockets.

(3) Portability of launcher and ammunition.

(4) Recoil when firing rockets at extreme and normal temperatures.

b. Armor piercing effect of 3.5" rocket as compared to 2.36" rocket and M9A1 rifle grenade when fired at angles of incidence of 90 and 45 degrees.

c. Effect of 3.5" rocket as compared to 75mm and 4.2" recoilless weapons when fired at Japanese type bunker and sand-bag wall.

d. Accuracy of and amount of leads required with 3.5" rocket when firing at moving target.

e. Sensitivity of 3.5" rocket to grazing impact as received and as modified.

f. Defects noted in the 3.5" rocket and launcher during tests conducted.

g. Other pertinent data.

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4. Details of Tests and Results.

Test No. 1

a. Purpose: To compare the subject 3.5" launcher and rocket with the standard 2.36" launcher and rocket.

b. Method: By measuring and weighing.

c. Results:

Launcher	T74	M9A2
Bore (inches)	3.5"	2.36"
Length overall (inches)	60.5"	60.75"
Length muzzle section (inches)	29.94"	30.56"
Length breech section (inches)	31.56"	31.12"
Length disassembled for carrying (inches)	33.0 "	31.5 "
Weight complete (pounds)	14.88	10.15
Weight muzzle section (pounds)	6.20	2.47
Weight breech section (pounds)	8.67	7.68
Ignition	Magneto	Magneto
Sight	Optical	Optical
Construction (metal)	Aluminum or alloy	Aluminum or alloy

Rocket	T80	M6A3
Length (inches)	24	19.37
Weight (pounds)	8.68	3.40
Filler	Cyclonite	Pentolite
Propellant	BBP	Standard

(See Figures 1 through 8)

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Test No. 2

a. Purpose: To compare the accuracy of the 3.5" and 2.36" rockets when firing at stationary targets.

b. Method:

(1) 6' x 6' panels were placed at 100, 200, 300 and 500 yards.

(2) Three rounds were fired at each panel and at maximum range.

(3) Hits and vertical dispersion were measured at the panels and dispersion on ground impact was measured.

(4) The stability of the rockets was noted during this test.

c. Results:

(1)

Rocket T80

		Panel Range	Dispersion (ft) average of 3 rounds Vertical	Lateral	on Ground	Average range of ground impact (yds.)	Remarks
Sight Setting (yds)	50	100	2.5	.5	73	110.7	hold high
	150	200	3.1	1.5	45	197.4	hold low
	200	300	4.3	1.8	26	302.6	
	350	500	6.2	2.5	51	523.1	hold low
	600	900	----	6.0	54	895.5	

Rocket M6A3

		Panel Range	Vertical	Lateral	on Ground	Average range of ground impact (yds.)
Sight Setting (yds)	100	100	3.5	2.2	51	116.6
	200	200	5.0	3.1	62	208.1
	300	300	7.0	7.4	47	320.2
	500	500	11.6	11.0	55	489.6
	600	600	----	15.6	60	575.2

NOTE: Vertical dispersion at ranges of 300 yards and over were estimated by observers to the flank.

(2) When firing at high angle (600 yards sight setting) one of the T80 rockets and two M6A3 rockets were noted to tumble. These shots were not counted in the range average. In all cases during low angle firing and during flight up to 500 yards both the T80 and M6A3 rockets had very little noticeable yaw.

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Test No. 3

a. Purpose: To determine the portability of the 3.5" Launcher, T74, and Rockets, T80.

b. Method:

(1) The subject launcher was carried two miles over various types of terrain to determine the ease of handling and conformation to carrier's body to prevent chafing.

(2) The subject launcher was carried on the shoulder while loaded and unloaded and the point of balance noted.

(3) The M2 carrying bag for mortar ammunition and the carrying bag for 2.36" rockets were loaded with T80 rockets and their suitability noted.

c. Results:

(1) During the two mile march the subject launcher was carried on either the left or right shoulder without discomfort to the carrier with the strap provided. (Figures 9 and 10)

(2) The T74 launcher does not balance at the shoulder stock when unloaded. When loaded the T74 launcher is well-balanced at the shoulder stock and can be carried without discomfort.

(3) The M2 Ammunition Bag was not suitable for carrying the T80 rockets.

(4) Three T80 rockets can be carried in the carrying bag for the 2.36" rockets.

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Carrying the 3.5" Launcher T74 (front).

Figure 9

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Carrying the 3.5" Launcher T74 (side).

Figure 10

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Test No. 4

a. Purpose: To determine the feasibility and method of packaging the 3.5" Rocket and launcher for airborne troops.

b. Method:

(1) The subject launcher and five rockets were packaged by The Parachute School.

(2) The subject launcher and rockets were used in an airborne landing by paratroop infantry and the effect on the launcher and rockets was noted.

(3) A rope was used to lower the rocket package prior to landing in order to reduce the landing shock.

c. Results:

(1) Both the launcher and five rockets were uninjured by the airborne handling and fired normally in subsequent tests.

(2) See Figures 11 through 16 for packaging and suspension on paratroop infantry.

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Loading of paratrooper with 3.5" Launcher T74 and five Rockets T80.

a - Launcher

b - Rockets

Figure 11

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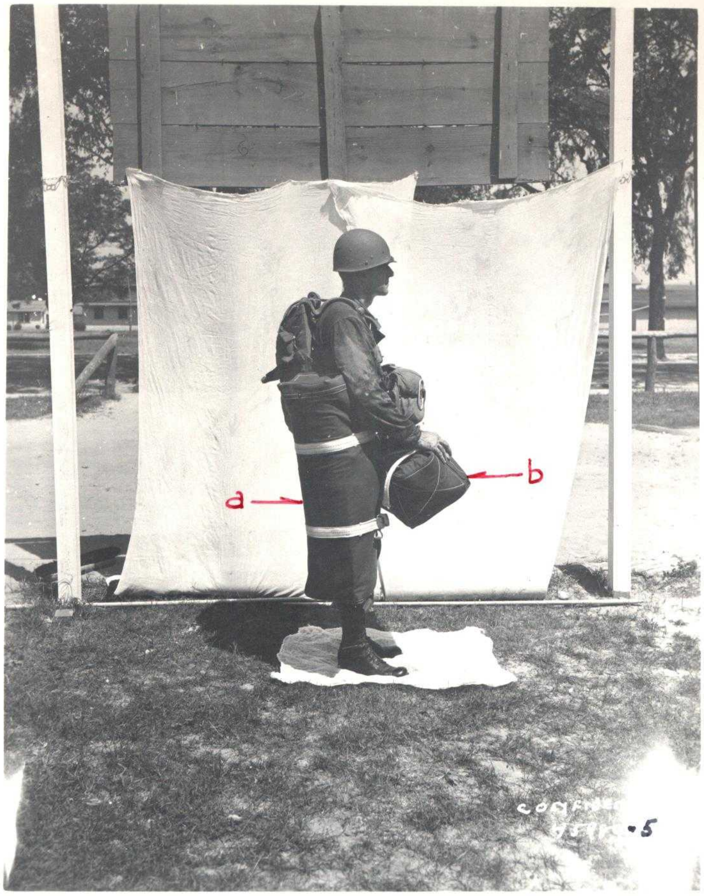

Loading of paratrooper with 3.5" Launcher T74 and five Rockets T80.

Figure 12

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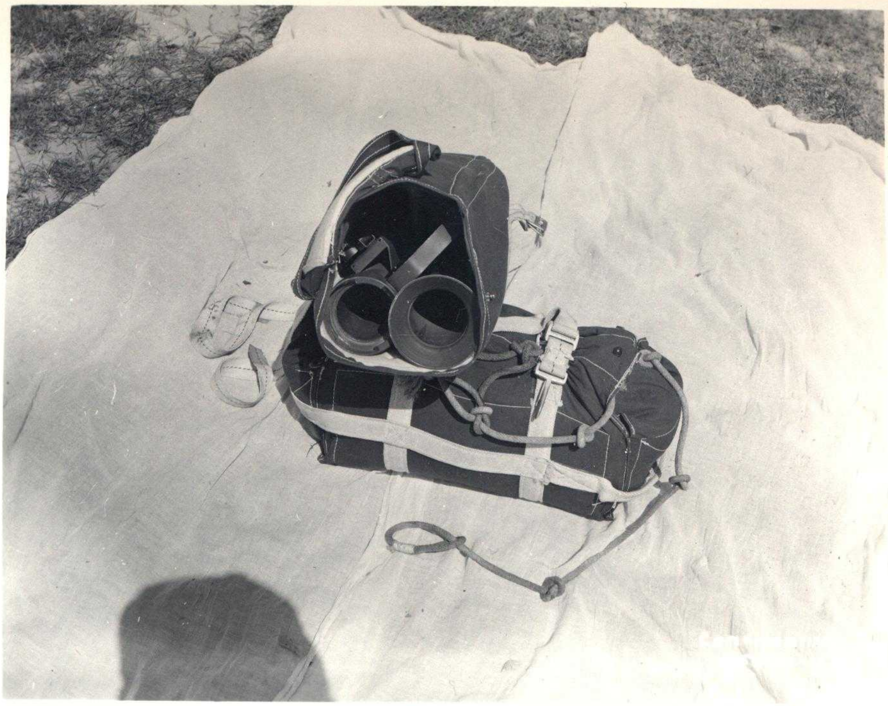

Airborne packaging of 3.5" Launcher T74.

Weight - 22 lbs.

Figure 13

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Airborne packaging of T80 Rockets.

Preliminary preparations for packing. Note padding that supports center section of rocket to prevent damage from the shock of landing. Knotted rope is for lowering bundle in order to reduce shock load on man.

Figure 14

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Airborne packaging of T80 Rockets.

Final step of packing. Note support to center section of rocket is carried out throughout package.

Figure 15

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Airborne Package containing five T80 Rockets.

Weight - 62 lbs.

Figure 16

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Test No. 5

a. Purpose: To compare the recoil of the T74 and M9E2 Launchers when firing their respective types of ammunition at normal temperatures.

b. Method:

(1) A pendulum was constructed and the resulting lift of the launcher noted at each firing. (Figure 17)

(2) Three rockets were fired by remote control to reduce the possible errors.

(3) The resulting lift was converted to foot pounds energy.

c. Results: Recoil energy (foot pounds):

Type of Rocket	T80		M6A3
Propellant	BBP		Standard
Type of Rocket	Practice	HE	Standard HE
Rocket No. 1	2.32	1.73	4.82
Rocket No. 2	2.77	4.02	9.20
Rocket No. 3	2.61	2.61	7.18
Average........	2.57	2.79	7.07

The above indicates that the 2.36" Rocket with standard propellant fired in the M9E2 Launcher has more than 100 percent more recoil than the 3.5" Rocket when fired in the T74 Launcher.

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Recoil test of 3.5" Rocket.

Launcher during recoil swings on pendulum. Vertical and horizontal movements were measured by use of lines on panel in order to record energy transfer.

Figure 17

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Test No. 6

a. Purpose: To determine the effect of subjecting the T80 Rockets to extreme temperatures on the recoil and back blast of the Launcher, T74.

b. Method:

(1) Two rockets were placed in a temperature of 120 deg. F. for 24 hours and then fired in a pendulum device.

(2) Two rockets were placed in a temperature of -8 deg. F. for 24 hours and then fired in a pendulum device.

(3) The amount of lift in each case was measured and recoil in foot pounds calculated.

(4) Paper panels were placed directly to the rear of the bell muzzle to determine if any back blast would be developed by the low temperatures.

c. Results:

(1) The following are the recoil measurements of the rounds fired:

Rocket	Temperature	Recoil (ft. pounds)
T80	120 deg. F.	2.62
T80	120 deg. F.	3.38
T80	-8 deg. F.	4.02
T80	-8 deg. F.	4.31

(2) There was no evidence of back blast when firing the rounds subjected to a temperature of -8 deg. F.

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Test No. 7

a. Purpose: To compare the armor piercing effect of the Rockets, T80, M6A3, and Rifle Grenade, M9A1, when fired at angles of incidence of 45 and 90 degrees.

b. Method:

(1) A laminated block of armor plate was constructed of $1\frac{1}{2}$" and 2" plates that had been used previously. (Figures 18 and 19)

(2) Three rounds each of Rockets T80, M6A3 and Rifle Grenades M9A1 were fired at angles of incidence of 45 deg. and 90 deg. and the resulting penetration noted.

c. Results:

(1) The following penetrations were noted at 90 deg. angle of incidence:

Ammunition	Penetration (inches) T80	M6A3	M9A1
Shot No. 1	5	5	$3\frac{1}{2}$
Shot No. 2	5	5	$3\frac{1}{2}$
Shot No. 3	5	5	$3\frac{1}{2}$

(Figures 20 and 21)

(2) Penetration from 45 deg. angle of incidence:

Shot No. 1	5	5	$3\frac{1}{2}$
Shot No. 2	5	$3\frac{1}{2}$	0 *
Shot No. 3	5	5	$3\frac{1}{2}$

(Figures 22 and 23)

All measurements were perforations of plates. Partial penetrations could not be measured.

*Grenade was deflected prior to detonation. (Figure 21)

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Front view of laminated armor plate used in test.
(Note previous damage.)

Figure 18

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Side view of laminated armor plate used in test. Plate thicknesses from right to left are: $1\frac{1}{2}$", 2", $1\frac{1}{2}$", $1\frac{1}{2}$", and $1\frac{1}{2}$".

Figure 19

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90-degree impact by 3.5" Rocket.

Penetration 5".

Figure 20

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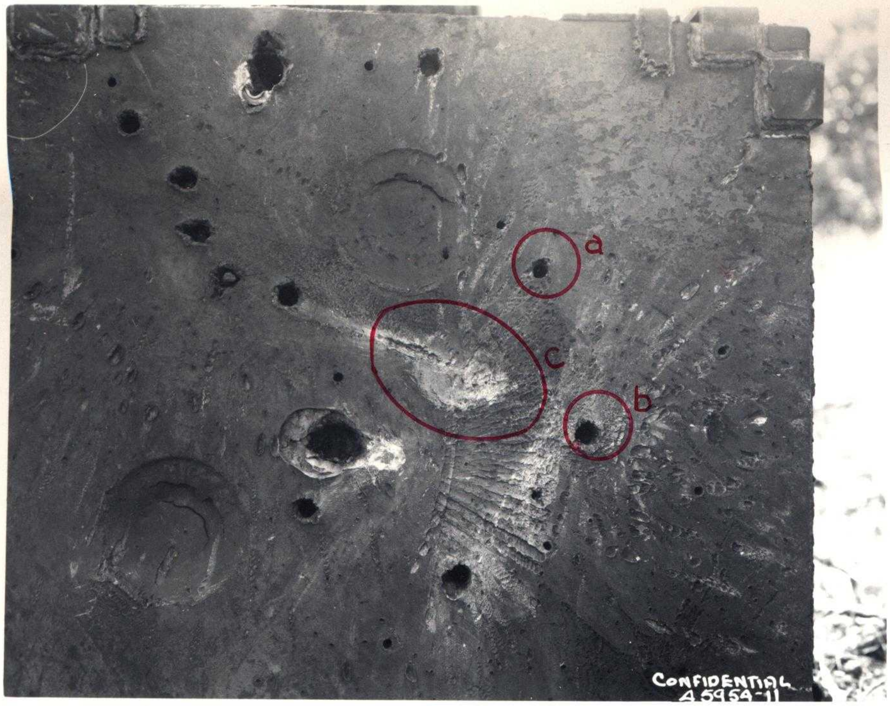

a - 90-deg. impact by M9A1 Rifle Grenade.
(Penetration 3-1/2")

b - 90-deg. impact by M6A3 Rocket.
(Penetration 5")

c - Failure of M9A1 to penetrate armor at
45-deg. angle of incidence.

Figure 21

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45-deg. impact by 3.5" Rocket. Penetration 5".

Figure 22

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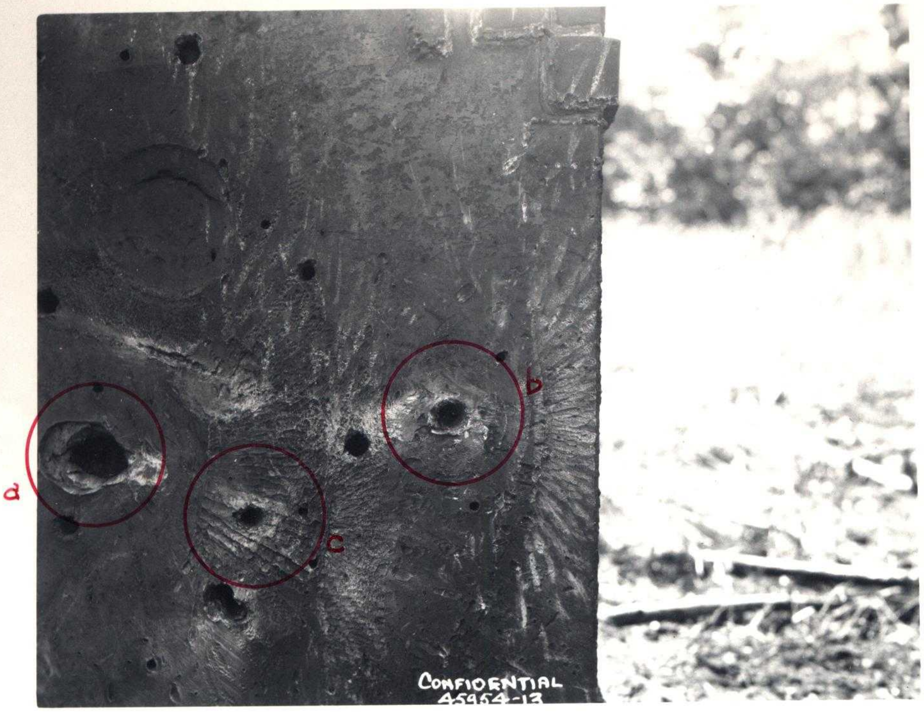

45-degree Impact

a - 3.5" Rocket - penetration 5".

b - 2.36" Rocket - penetration 5".

c - M9A1 Rifle Grenade - penetration 3-1/2".

Figure 23

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Test No. 8

a. Purpose: To compare the effect of the 3.5" Rocket with that of the 75mm and 4.2" Recoilless weapons when fired at a Japanese type bunker.

b. Method:

(1) Three rounds of each type of weapon were fired at the aperture of a Japanese type bunker constructed of 14" logs and having a double log wall with a 5-foot earth fill between.

(2) Firing was conducted from a point 10 degrees to the left of the bunker entrance and at a range of 120 yards.

(3) The effect of each round fired was noted and photographs taken.

(4) Fuzes on the 75mm shell were set delay.

c. Results:

(1) Three rounds of subject rockets fired at the aperture of the bunker damaged the entrance and displaced a large log. No damage to the interior was noted. (Figures 24, 25, 26 and 27.)

(2) Two of the 75mm shells detonated in the back wall of the bunker and caused no material damage to either the bunker interior or exterior components. A third shot detonated under one corner of the bunker, loosened some dirt and moved a log on the interior of the bunker. No fragments entered the main chamber. (Figure 28)

(3) Two rounds fired from the 4.2" Recoilless Mortar ricocheted through the top of the bunker and did no damage. The third round detonated within the earth fill and opened the bunker to the inner log wall. No fragments entered the main chamber but the bunker could have been easily attacked with flame throwers through the damaged wall. (Figure 29)

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Test No. 9

a. Purpose: To compare the effect of the 3.5" Rocket with that of the 2.36" Rocket, M9A1 Rifle Grenade and 75mm and 4.2" Recoilless weapons when fired at sand-bag emplacements.

b. Method:

(1) A sand-bag wall 5 feet high, 4 feet thick, and 10 feet long was constructed of interlocking sacks. (Figures 30 and 31)

(2) Firing was conducted with each of the above weapons until a hit was scored and the results noted.

c. Results:

(1) The M9A1 Rifle Grenade caused only superficial damage to the sand-bag wall. (Figure 32)

(2) The 2.36" Rocket displaced several sand-bags but damage was superficial. (Figure 33)

(3) The 3.5" Rocket destroyed a section of the sand-bag wall but none of the fragments perforated the wall. (Figure 34)

(4) The 75mm Recoilless fired with fuze delay knocked down a section of the sand-bag wall and detonated 5 feet behind the wall. (Figure 35)

(5) The 4.2" Recoilless Mortar shell penetrated most of the wall of sand-bags and demolished the main portion of bags. (Figure 36)

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Construction of sand bag wall. (front)

Figure 30

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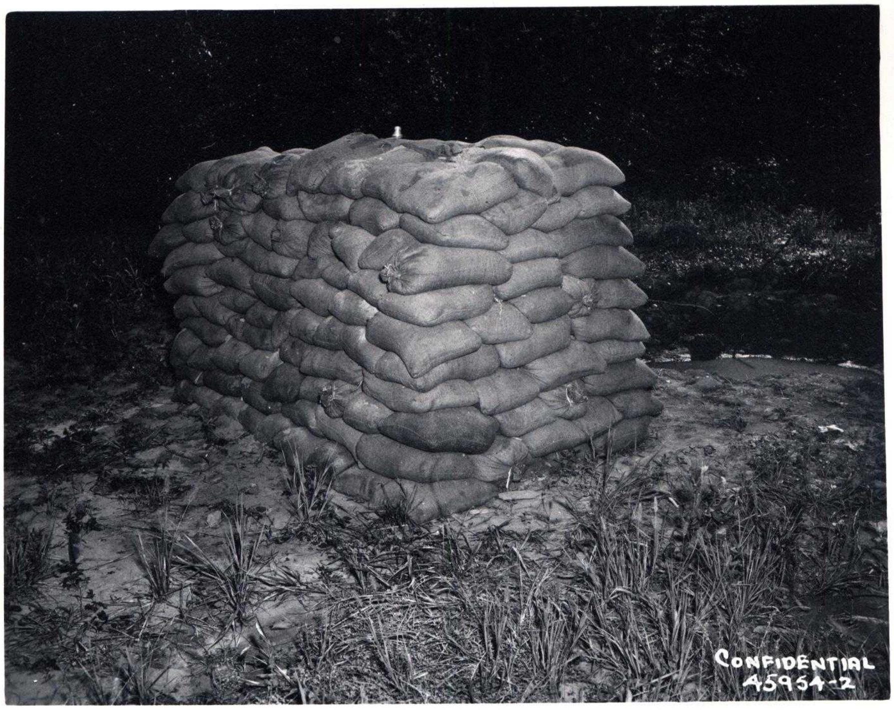

Construction of sand bag wall. (side)

Figure 31

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Effect of M9A1 Rifle Grenade on sand bag wall.

Figure 32

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Effect of M6A3 Rocket on sand bag wall.

a - Point of detonation.

Figure 33

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Effect of 3.5" Rocket on sand bag wall.

A section of the wall was damaged; however, no fragmentation penetrated the barrier.

Figure 34

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Effect of 75mm Recoilless Rifle on sand bag wall - fuze delay.

Shell knocked down wall section on impact and detonated five feet behind wall.

Figure 35

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Effect of 4.2" Recoilless Mortar on sand bag wall. Shell demolished wall.

Figure 36

Test No. 10

a. Purpose: To compare the accuracy of the 3.5" Rocket, T80, and Launcher, T74, with that of the M9E2 Launcher and M6A3 Rocket when firing at moving targets.

b. Method:

(1) a 6' x 6' towed target was used at a speed of 10 mph.

(2) The firing point was 200 yards from the moving target.

(3) Twelve rockets of each type were fired at the moving target. Six were fired with the target moving from right to left and six with the target moving from left to right.

(4) A record was kept of hits and relative lead information securing hits.

c. Results:

(1) Note the following tabulation:

Rockets	T80		M6A3	
Direction of target	right to left	left to right	right to left	left to rig
Rounds fired	6	6	6	6
No. of Hits	3	2	0	1
No. with correct lead	5	4	2	3
Mils lead	50	40	50	50

(2) The average lead necessary to hit a moving target with the 3.5" Rocket is 45 mils when the target is moving 10 mph or a lead of 4.5 mils per mile per hour.

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Test No. 11

a. Purpose: To determine the sensitivity of the 3.5" Rocket to grazing impact.

b. Method:

(1) A record was kept of rockets fired at short ranges, functioning of the fuze upon impact, and type of impact surface.

(2) Five grenades were modified by installing a rounded ogive. (Figure 37)

(3) Three of these modified Rockets were fired at low angles where the pointed T80 Rockets had failed and the results noted.

c. Results:

(1) Rockets fired into soft sand.

Rocket	T80 as received	T80 Modified.
No. of rockets fired into sand	12	0
Range (yds.)	200	
Number of impact detonations	10	

(2) Rockets fired onto hard ground

Rocket	T80 as received	T80 Modified
No. of rockets fired onto hard ground at a range of 200 yds.	5	3
No. of impact detonations	2	3
No. of rockets fired onto hard ground at a range of 300 yds.	5	1
No. of impact detonations	3	1

(3) When the subject rockets (unmodified) were fired onto hard ground at low angles, the glancing impact appeared to collapse the center of the rocket and jam the fuze assembly before it functioned. In almost every case where rockets struck the ground at a low angle and did not detonate, the rocket broke into two or more pieces usually at the junction of the components of the fuze.

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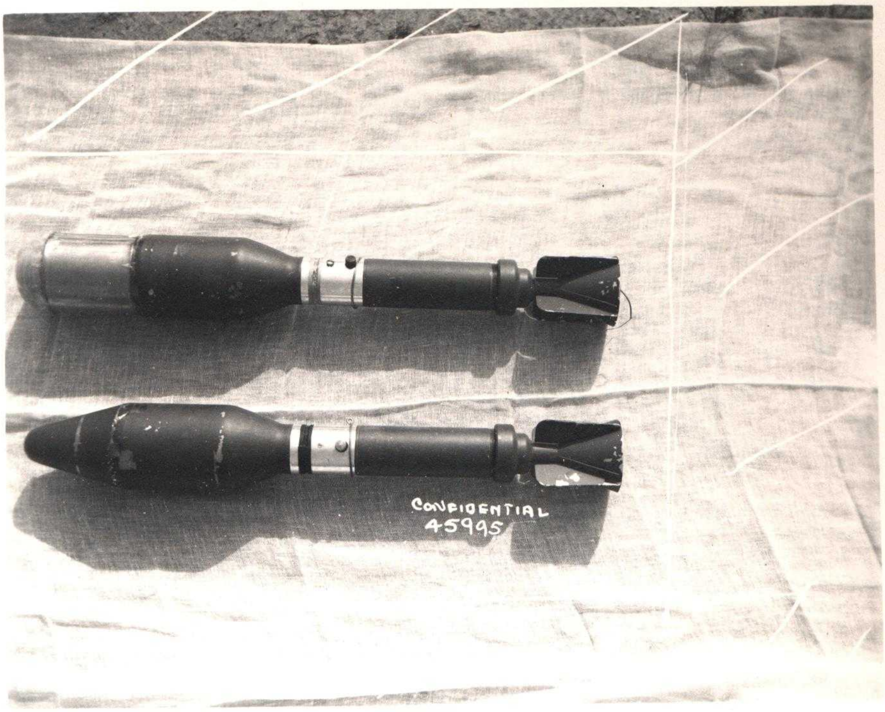
1

2



Modified Ogive on T80 Rocket.

1. T80 Rocket with metal and rounded wood nose ogive.

2. T80 Rocket as received (note pointed ogive).

Figure 37

Test No. 12

a. Purpose: To determine if the modified ogive on the Rocket T80 affected the stability and armor piercing effect of the rocket.

b. Method:

(1) The modified rockets were observed during the firing. (Test No. 10)

(2) One Rocket was fired at maximum range and flight noted.

(3) One round was fired at armor plate (90 deg. angle) and the effect noted.

c. Results:

(1) The modified ogive did not appear to affect the stability of the T80 Rocket when fired at low angles of elevation.

(2) The modified rocket fired at maximum range tumbled in flight but stabilized after traveling approximately 700 yards, and functioned normally except for the reduction in range.

(3) The modified ogive appeared not to affect the armor piercing qualities of the T80 Rocket. Five inches of armor was perforated by the one round fired.

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Test No. 13

a. Purpose:

(1) To determine the length of the back blast of the T74 Launcher and T80 Rocket at normal temperature.

(2) To determine the distance the T80 Rocket burns in the tube when fired at normal temperature.

b. Method:

(1) A time photograph was taken of the blast of the T74 Launcher when fired and the resulting blast picture calibrated.

(2) A time photograph was taken of the blast of the T80 Rocket when fired from the rear section of the T74 Launcher. The resulting muzzle flash was calibrated.

c. Results:

(1) The back blast of the T74 Launcher and T80 Rocket is 14.1 feet when fired at normal temperature. (Figure 38)

(2) The propellant of the T80 Rocket is burning approximately 11 inches into the front section of the launcher tube. (Figure 39)

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Back blast of T80 Rocket fired from T74 Launcher.

Length of flame - 14.1 feet.

Figure 38

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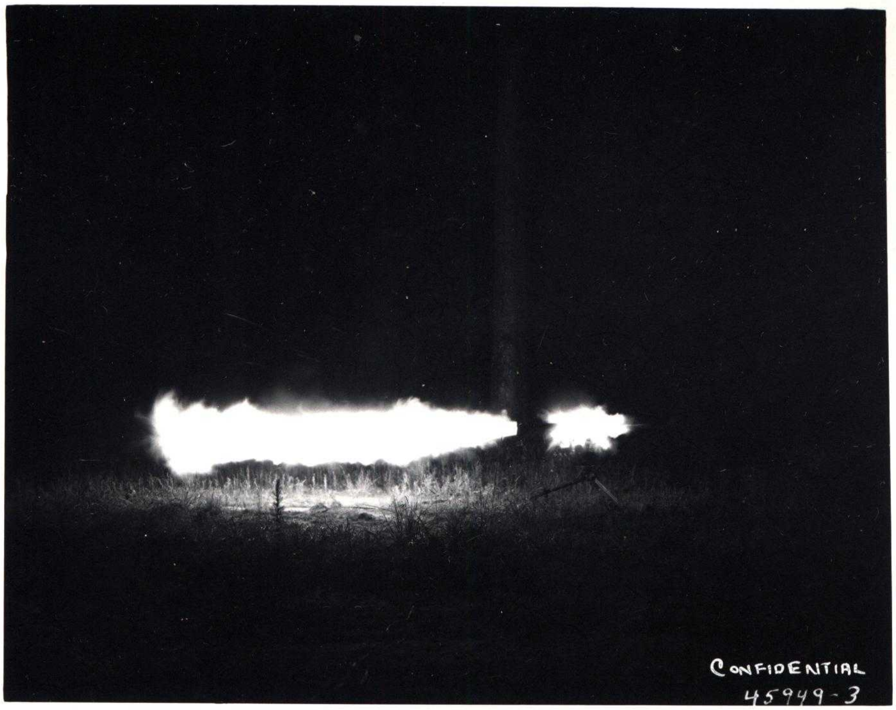

Burning Time of Propellent (BBP)

T80 Rocket fired from base section of launcher. The propellent flame traveled 11" into the second section of the launcher.

Figure 39

Test No. 14

a. Purpose:

(1) To determine the ease of firing the T74 Launcher in the standing, kneeling and prone positions.

(2) To determine the practicability of the tripod on the T80 Launcher.

b. Method:

(1) By observation of firing of the subject launcher in the standing, kneeling and prone positions.

(2) By observation of firing of the T80 Launcher from the tripod.

c. Results:

(1) The T80 Launcher may be easily fired from the standing, kneeling and prone positions. (Figures 40, 41 and 42.)

(2) The tripod on the T74 Launcher has a fixed height of the two front legs and a small amount of adjustment for the stand (Figure 6). This limited amount of adjustment is not sufficiently flexible to be used on uneven terrain.

(3) During all off shoulder firing it was noted that the small amount of recoil of the T74 Launcher pushed the sight into the face of the firer. It is believed that the rubber eye-cup for the M9E2 Launcher 2.36" should also be used on the 3.5" Launcher.

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3.5" Launcher fired from standing position. No rubber eye cup was furnished on the optical sight on this launcher; therefore, the firer's eye had to be held away from the sight in order to prevent bruising. Note small amount of smoke to rear of launcher.

Figure 40

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3.5" Launcher fired from kneeling position.

Figure 41

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3.5" Launcher fired from prone position.

Care must be taken to swing body and legs well out of line of blast.

Figure 42

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Test No. 15

a. Purpose: To record defects noted during the tests conducted on the 3.5" Launcher and Rockets.

b. Method: By inspection of failures noted during tests.

c. Results:

(1) During the firing of 83 rockets, there were six ignition failures. All failures were due to ignition wires shorting out on the propellant cage within the propellant chamber.

(2) One round was found with the bore rider in the fuze. The set back had operated but the bore rider remained with the rocket during its 900 yard flight and came out when the rocket was withdrawn from the ground. (Figure 43)

(3) All ignition wires on the T80 Rockets were too short.

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Failure to arm.

Bore rider remained in rocket. Rocket was found embedded 10" in hard clay 900 yards from firing point. This was the only HE Rocket dud recovered intact.

Figure 43

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Test No. 16

a. Purpose: To note other information recorded during tests.

b. Method: Observation of tests conducted.

c. Results:

(1) One Rocket T80 struck soft, marshy ground when fired 900 yards and made a crater 5 feet wide and $2\frac{1}{2}$ feet deep. (Figure 44)

(2) During the test firing it was noted that the blast of the T74 Launcher was not uncomfortable to the firer when firing from the shoulder; however, observers at a range of 10 yards to the side had to wear ear plugs.

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3.5" Rocket crater in marshy ground. Rocket fired 915 yards made crater 5 feet in diameter and $2\frac{1}{2}$ feet deep.

Figure 44

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5. Summary of Facts Determined by Tests:

a. The following are physical characteristics of the T74 and M9E2 launchers and the T80 and M6A3 Rockets. (Test No. 1)

Launcher	T74	M9E2
Bore (inches)	3.5	2.36
Length overall (inches)	60.5	60.75
Length disassembled for carrying (in.)	33.0	31.5
Weight (pounds)	14.88	10.15
Construction	Aluminum or alloy	Aluminum or alloy

Rocket	T80	M6A3
Length (inches)	24	19.37
Weight (pounds)	8.68	3.40
Filler	Cyclonite	Pentolite
Propellant	BBP	Standard

b. The T80 Rocket has less lateral and vertical dispersion than the M6A3 rocket at the same range. (Test No. 2)

The T80 Rocket has 50% more range at the same sight setting than the M6A3 rocket. (Test No. 2)

One of the T80 and two M6A3 rockets out of three each fired, tumbled when fired at maximum range. (Test No. 2)

Only a slight tendency to yaw was noted in the flight of the T80 and M6A3 rockets when firing at low angles. (Test No. 2)

c. The T74 Launcher does not cause the carrier any discomfort when slung on either the left or right shoulder. (Test No. 3)

The T74 Launcher is unbalanced at the shoulder stock when unloaded but is well-balanced with the rocket in the launcher. (Test No. 3)

The ammunition carrying bag for the 2.36" rockets will hold 3 T80 Rockets. (Test No. 3)

d. The T74 launcher and T80 rockets appear suitable for transport by airborne troops. (Test No. 4)

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e. The M9E2 launcher firing rockets with the standard propellant has over 100% more recoil than that of the T74 Launcher. (Test No. 5)

f. Extreme temperatures have little effect on the recoil of the T80 rocket when fired in the T74 launcher. (Test No. 6)

There was no evidence of back blast from the T74 launcher muzzle when firing ammunition subject to a temperature of -8°F. (Test No. 6)

g. The following armor piercing ability was noted when firing the T80 and M6A3 rockets and M9A1 rifle grenade. (Test No. 7)

		Maximum Penetration (inches)		
		T80	M6A3	M9A1
Angle of incident	90°	5	5	$3\frac{1}{2}$
	45°	5	5	$3\frac{1}{2}$

h. The T80 rocket causes only superficial damage to a Japanese type bunker built of logs and earth. (Test No. 8)

The 75mm and 4.2" Recoilless weapons will penetrate the bunker and detonate within the walls causing damage. (Test No. 8)

i. The following is the result of firing at a sand-bag wall four feet thick. (Test No. 9)

Projectile	Effect on wall
M9A1 Rifle Grenade	Superficial damage
M6A3 Rocket	Superficial damage
T80 Rocket	Damaged wall but did not perforate
75mm Recoilless (delay)	Knocked down wall and detonated on far side after traveling 5 feet
4.2" Recoilless Mortar	Shell detonated in wall destroying wall.

j. The T74 launcher and T80 rocket are more accurate when firing at moving targets than the M9E2 launcher and M6A3 rocket. (Test No. 10)

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The T74 launcher and T80 rocket require a lead of 4.5 mils per mile per hour (lateral movement of the target) when firing at moving targets. (Test No. 10)

k. Two T80 rockets out of 12 fired failed to detonate on grazing impact on dry sand. (Test No. 11)

The addition of a rounded ogive in place of the pointed ogive increased detonations on rounds grazing hard ground approximately 100%. (Test No. 11)

T80 rockets which did not detonate when striking the ground broke into two or more pieces. (Test No. 11)

l. The increased stand off of the rounded ogive apparently did not affect the armor piercing quality of the T80 rocket. (Test No. 12)

The rounded ogive did not affect the flight of the T80 rocket at low angles. (Test No. 12)

One T80 rocket with rounded ogive tumbled badly in flight after traveling approximately 700 yards. (Test No. 12)

m. The T74 launcher has a back blast to the rear of 14.1 feet. (Test No. 13)

The T80 rocket burns approximately 11 inches into the front section of the T74 launcher tube. (Test No. 13)

n. The T74 launcher is easily fired from the standing, kneeling and prone positions. (Test No. 14)

The tripod on the T74 launcher is not sufficiently flexible for use on uneven terrain. (Test No. 14)

The rubber eye-cup used on the M9E2 launcher sight should be used on the sight on the T74 launcher. (Test No. 14)

o. The following defects were noted during tests conducted:

(1) Six rockets failed to ignite due to ignition wires being shorted on the propellant cage in the propellant chamber.

(2) One HE round fired 900 yards operated the set back device but the bore rider remained in the fuze.

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(3) Ignition wires on all T80 rockets were too short.

p. One T80 rocket made a crater 2-1/2 feet deep and 5 feet wide in marshy ground. (Test No. 16)

q. The blast of the 3.5" rocket is not injurious to the firer's ears but affects the ears of observers standing 10 yards to the side of the launcher.

W. S. SINCLAIR,
Major, Infantry,
Test Officer.

I concur in the above Record of Test:

EDWARD B. CROSSMAN,
Major, Infantry,
Acting Chief of Test Section.